OSTM

Ocean Surface Topography Mission

OSTM URLs
sealevel.jpl.nasa.gov/mission/ostm.html
www.aviso.oceanobs.com/

Note on Mission Name: The French have referred to this mission as Jason-2, since it is a follow-on mission to Jason. However, NASA is using the name OSTM and therefore, that name will be used in this entry. The only exception is where the position titles of French scientists involved in the mission are listed.

Summary

OSTM, a continuation of the TOPEX/Poseidon and Jason missions, is based on the science and pre-operational returns of these two missions and will support global and regional operational applications. Like its predecessors, OSTM will map ocean surface topography and the data collected will provide information on ocean surface current velocity and heights which, when combined with ocean models, can lead to a four-dimensional description of ocean circulation. Data from OSTM will extend the time series of ocean surface topography measurements for detecting previously unknown changes on decadal scales, increase understanding of ocean circulation, improve forecasting of climate events, and measure global sea level change.

Instruments

- Advanced Microwave Radiometer (AMR)
- Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS) satellite tracking system
- GPS Payload receiver (GPSP)
- Laser Retroreflector Array (LRA)
- Poseidon-3 altimeter

Key OSTM Facts

Joint with NOAA, CNES, and EUMETSAT

Orbit
Type: Circular, non-sun-synchronous
Descending Node: N/A
Altitude: 1336 km
Inclination: 66°
Period: 112.4 minutes
Repeat Cycle: 9.9156 days

Dimensions
Platform module: 95.4 cm × 95.4 cm × 100.0 cm
Payload module: 95.4 cm × 95.4 cm × 121.8 cm
Solar array span: Two wings with four 1.5 m × 0.8 m panels per wing

Mass: 500 kg

Power: 580 W

Downlink: S-Band to JPL, Wallops Island, Virginia, Poker Flats, Alaska, Aussaguel, France, and a site in Germany

Design Life: 3-year primary mission; 2-year extended mission

Contributors: NASA, NOAA, Centre National d'Etudes Spatiales (CNES), European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT)

Points of Contact

- *U.S. OSTM Project Scientist:* Lee-Lueng Fu, NASA Jet Propulsion Laboratory/California Institute of Technology
- *French OSTM Project Scientist:* Yves Menard, CNES Toulouse Space Center

Other Key Personnel

- *OSTM Program Scientist:* Eric Lindstrom, NASA Headquarters
- *OSTM Program Executive:* Steve Neeck, NASA Headquarters
- *OSTM Project Manager:* Parag Vaze, NASA Jet Propulsion Laboratory/California Institute of Technology
- *OSTM Program Manager:* Mike Mignogno, NOAA NESDIS
- *OSTM Project Manager:* Walid Bannoura, NOAA NESDIS

- *OSTM Program Manager:* Mikael Rattenborg, EUMETSAT
- *Jason-2 Program Manager:* Eric Thouvenot, CNES Toulouse Space Center
- *Jason-2 Project Manager:* Jacqueline Perbos, CNES Toulouse Space Center

Mission Type

Next Generation Systematic Measurements

Launch

- *Date and Location:* No earlier than June 2008, from Vandenberg Air Force Base, California

Relevant Science Focus Areas

(see NASA's Earth Science Program section)

- Climate Variability and Change
- Water and Energy Cycles

Related Applications

(see Applied Sciences Program section)

- Coastal Management
- Disaster Management

OSTM Science Goals

OSTM will continue to satisfy the following science goals of the ocean surface topography effort:

- Determine general ocean circulation and understand its role in Earth's climate, particularly how ocean circulation impacts Earth's hydrological and biogeochemical cycles.
- Study the variation of ocean circulation on time scales ranging from seasonal and annual to decadal and examine how this variation impacts climate change.
- Collaborate with other global ocean-monitoring programs to produce routine models of the global ocean for scientific and operational applications.
- Study large-scale ocean tides.
- Study geophysical processes and their effects on ocean surface topography.

OSTM Instruments

AMR
Advanced Microwave Radiometer

AMR is a three-frequency microwave radiometer that measures total water vapor along the path viewed by the altimeter and is used for range correction. It measures brightness temperatures in the nadir column at 18.7, 23.8, and 34 GHz.

DORIS
Doppler Orbitography and Radiopositioning Integrated by Satellite

DORIS is a precision orbit determination system that provides orbital positioning information. An onboard receiver accurately measures the Doppler shift on both transmitted frequencies (401.25 and 2.036 GHz) received from an orbit determination beacon (ODB) station.

GPSP
GPS Payload receiver

GPSP will be a high performance GPS receiver designed to provide tracking data for precise orbit determination of the OSTM spacecraft. It is derived from the TRSR (Turbo Rogue Space Receiver) flown on Jason. It will measure precision GPS code phase and continuous carrier phase data from up to 12 GPS satellites.

LRA
Laser Retroreflector Array

As on TOPEX/Poseidon and Jason, the OSTM LRA will be used to calibrate the other location systems on the satellite with a very high degree of precision. LRA is a totally passive reflector designed to reflect laser pulses back to their point of origin on Earth. It consists of nine suprasil quartz retroreflectors arranged to provide a near-hemispherical response.

Poseidon-3

Poseidon-3 is a next generation dual-frequency radar altimeter. It is an improved version of Poseidon-2, the dual-frequency radar altimeter flown on Jason.

OSTM Mission Background

OSTM will provide continuity of ocean topography measurements beyond TOPEX/Poseidon and Jason. This mission will continue the critically important multi-decadal record of ocean topography measurements for ocean circulation and climate studies. The systematic measurements obtained by OSTM will provide required knowledge to answer key NASA science questions and help scientists observe, understand, and model the Earth system to learn how it is changing, and the consequences for life on Earth.

The instruments on OSTM are either identical to or slightly improved versions of those flown on Jason. OSTM will use the same measurement approach as Jason, and will be developed and operated as a four-party international collaboration among NASA, NOAA, CNES, and EUMETSAT. After the OSTM mission is complete, the intent is that the operational community will assume responsibility for future sea surface topography measurements.

Otherwise, the OSTM mission background is the same as Jason. Please see the Jason entry for complete details.

AMR

Advanced Microwave Radiometer

AMR is an enhanced version of the Jason Microwave Radiometer (JMR)—see Jason entry for complete description. It offers virtually the same capabilities as JMR but is smaller, consumes less power, and has a faster data rate. JPL has overall responsibility for AMR management, system design, electronics development, integration and test, and calibration.

DORIS

Doppler Orbitography and Radiopositioning Integrated by Satellite

The DORIS instruments slated for the OSTM mission are upgraded versions of those aboard Jason—see Jason entry for complete description of DORIS. Experience with SPOT-2, SPOT-4, TOPEX/Poseidon, and Jason has shown that the instrument operates most efficiently at altitudes between 750 and 1,500 km. However, DORIS can operate at altitudes from 300 km to several thousand km.

Key AMR Facts

Heritage: TOPEX/Poseidon, Seasat, Nimbus-7

Instrument Type: Three-channel microwave radiometer

Scan Type: Fixed pencil-beam spatially collocated with the nadir-pointing Poseidon-3 altimeter beam

Channel Center Frequencies: 18.7, 23.8, and 34.0 GHz

Channel Bandwidths: 200, 400, and 700 MHz

Antenna Half-Power Beamwidth: 1.8°, 1.4°, and 1.0°

Dimensions:

Antenna: 1-m offset feed parabola

Electronics module: 11 cm × 16 cm × 16 cm (primary and redundant)

Mass: 16 kg

Power: 15 W

Data Rate: 2.5 kbps (maximum)

Thermal Control: Electronics thermal control provided by passive radiator to space

Thermal Operating Range: 0° to 40° C (for electronics)

Radiometric Resolution: < 0.25 K

Absolute Calibration Accuracy: ±1 K

Contributors: NASA JPL (responsible center, instrument design)

Key DORIS Facts

Heritage: SPOT-2, TOPEX/Poseidon, SPOT-3, SPOT-4, Envisat, Jason

Instrument Type: Precision Orbit Determination System

Dimensions:

Receiver Package: 31 cm × 35 cm × 17 cm (Dual receivers + Ultra Stable Oscillator)

Antenna: 37 cm height × 16 cm diameter cone

Mass:

Receiver Package: 17.9 kg

Antenna: 2 kg

Power: 21 W

Duty Cycle: 100%

Data Rate: 330 bps

Thermal Control: Heat transfer by conduction to mounting surface and by radiation within the instrument module

GPSP

GPS Payload receiver

GPSP is essentially a slightly enhanced version of the Turbo Rogue Space Receiver (TRSR) on Jason. The description of GPSP is essentially identical to that of the TRSR found in the Jason entry. NASA's Jet Propulsion Laboratory at the California Institute of Technology will design and test the GPSP hardware, software, and ground support equipment. Spectrum Astro, Inc. will construct and test the GPSP flight unit.

GPSP URL

sealevel.jpl.nasa.gov/technology/instrument-gps.html

LRA

Laser Retroreflector Array

The LRA on OSTM is identical to the LRA on Jason. See the Jason entry for a detailed description of LRA.

Poseidon-3

Poseidon-3 is an enhanced version of the Poseidon-2 radiometer described in detail in the Jason entry. The microprocessor on Poseidon-3 (DSP 21020) is updated from Poseidon-2. Poseidon-3 also has an adaptive acquisition window based on the Doris/Diode on board. A land elevation model is also programmed in to improve Poseidon-3's ability to track coastal and land areas.

Poseidon-3 URL

www.aviso.oceanobs.com/html/missions/jason2/instruments/poseidon3_uk.html

Key DORIS Facts *(cont.)*

Thermal Operating Range: -10° to 50° C

FOV: 125° cone (centered on nadir)

Pointing Requirements (platform + instrument, 3σ):

Control: 1.5°

Knowledge: 0.2° (depending on the distance between the antenna phase center and the satellite center of mass)

Contributors: CNES (responsible center), THALES (instrument), SMP (ground beacons)

Key GPSP Facts

Heritage: Blackjack GPS receiver (Shuttle Radar Topography Mission, Jason)

Instrument Type: GPS Receiver and antenna

Dimensions:

Receiver: 18 cm × 18 cm × 11 cm

Antenna: 10.5-cm height × 30-cm diameter

Mass:

Receiver: 2.5 kg

Antenna: 1 kg

Total: 7 kg (Dual-string configuration)

Power: 14W @ 28 V

Duty Cycle: 100%

Data Rate: 800 bps

Thermal Control: Heat transfer by conduction to mounting surface and by radiation within the instrument module

Thermal Operating Range: -10° to 50° C

Pointing Requirements (platform + instrument, 3σ):

Control: 5°

Knowledge: 5°

Contributors: JPL (responsible center); Spectrum Astro (instrument)

Key LRA Facts

Heritage: TOPEX/Poseidon, Jason

Function: Laser-tracking targets

Wavelengths: 532 nm (primary), 1064 nm (secondary)

Configuration: 9 corner cubes: 1 nadir looking, 8 arrayed azimuthally in truncated cone

FOV: 110° w/1.5 arcsec dihedral angle per cube

OSTM References

Escudier P., G. Kunstmann, F. Parisot, R. Boain, T. Lafon, P. Hoze, and S. Kaki, 2000: Jason System Overview and Status. AVISO Newsletter, Altimetry Edition, No. 7.

Mitchum G., R. Cheney, L. L. Fu, C. Le Provost, Y. Menard, and P. Woodworth, 2001: The future of sea surface height observations. In *Observing the Oceans in the 21st Century*, ed. by C. J. Koblinsky and N. R. Smith, GODAE and Bureau of Meteorology, Melbourne, Australia.

Key LRA Facts *(cont.)*

Dimensions: Each cube is 163-mm diameter × 66-mm height

Mass: 0.8 kg

Duty Cycle: 100%

Thermal Operating Range: -65º to 95º C

Contributors: NASA (responsible center), ITE Inc. (instrument)

Key Poseidon-3 Facts

Heritage: Poseidon-2 radar altimeter (Jason); Synthetic Aperture Interferometric Radar Altimeter–SIRAL (CryoSat)

Instrument Type: Dual-frequency radar altimeter (Ku-band and C-band)

Scan Type: Fixed nadir-pointing beam

Transmitted Pulse Width: 105 s

Pulse Repetition Frequency: 2100 Hz (1800 Hz for Ku-band and 300 Hz for C-band)

Maximum Radio-Frequency Output Power to Antenna: 38.5 dBm (Ku-band); 44 dBm (C-band)

Transmission Frequency: 13.575 GHz (Ku-band), 5.3 GHz (C-band)

Dimensions:

Radio Frequency Unit (RFU): 42.2 cm × 24.6 cm × 24.5 cm

Power Control (PC) Unit: 26.8 cm × 20.5 cm × 24.9 cm

Mass: 52 kg (dual-frequency, dual configuration with one antenna)

Power: 70 W (50 V for RFU, 20 V for PCU)

Duty Cycle: 100%

Data Rate: 22.5 kbps (including waveform data and onboard estimated parameters)

Thermal Control: Heat transfer by conduction to mounting surface and by radiation within the instrument module

Thermal Operating Range: -5° to 35° C

Pointing Requirements (platform + instrument, 3σ):

Control (Satellite): 0.33º

Knowledge: < 0.1º

Contributors: CNES (responsible center), Alcatel Space Industries (prime contractor)

OSTM Data Products

NOAA and EUMETSAT will distribute Operational Geophysical Data Records (OGDR) and Interim Geophysical Data Records (IGDR). NOAA and CNES will distribute Geophysical Data Record (GDR) products.

Product Name or Grouping	Processing Level	Coverage	Spatial/Temporal Characteristics
AMR, DORIS, GPSP, LRA, Poseidon-3			
Operational Geophysical Data Record	2	Global	66° N – 66° S latitude/every 10 days
Interim Geophysical Data Record	2	Global	66° N – 66° S latitude/delivered daily (latency 1–3 days)
Geophysical Data Record	2	Global	66° N – 66° S latitude/every 10 days

OSTM Data Products